

CROSSWALK LAWS AND VISION ZERO

Presentation
to SHSP
Pedestrians
Challenge
Area

Meghan Mitman
February 2017

A high-angle, close-up photograph of a person's lower legs and feet as they walk across a crosswalk. The crosswalk is marked with wide, parallel yellow stripes on a dark asphalt surface. The person is wearing grey leggings, a grey textured knee-length skirt or coat, and bright pink sneakers with white laces and white soles. A sharp shadow of the person's leg and foot is cast onto the yellow stripe they are stepping on. The text "UNCONTROLLED CROSSINGS" is overlaid in white, bold, sans-serif capital letters in the lower-left quadrant of the image.

UNCONTROLLED CROSSINGS

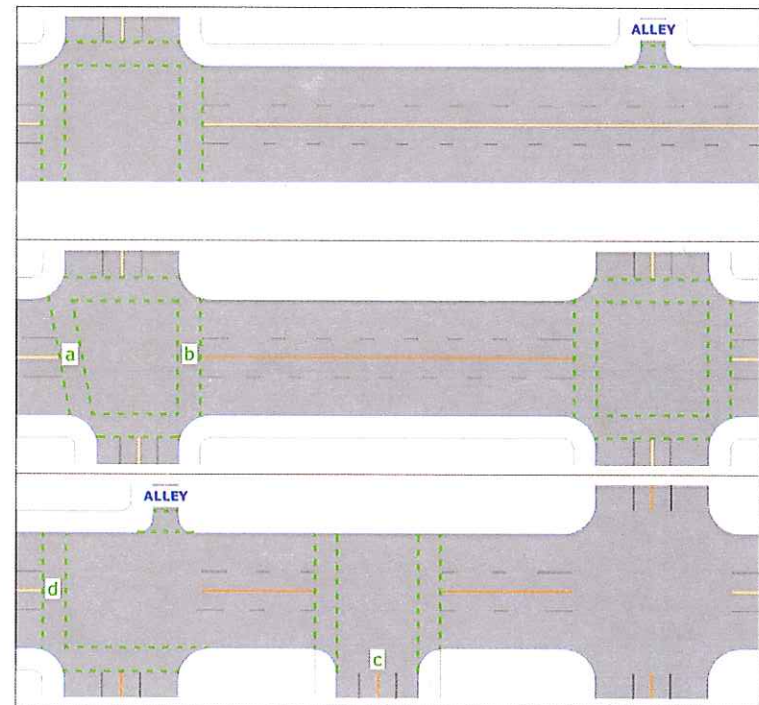
UNCONTROLLED CROSSINGS DECISION MAKING & DESIGN

What is an Unmarked Crosswalk?

California Vehicle Code §275

“Crosswalk” is either:

- a) That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at intersections where the intersecting roadways meet at approximately right angles, except the prolongation of such lines from an alley across a street.
- b) Any portion of a roadway distinctly indicated for pedestrian crossing by lines or other markings on the surface.





CALIFORNIA LAWS GOVERNING PEDESTRIAN SAFETY

Legislative intent:

21949. (a) The Legislature hereby finds and declares that it is the policy of the State of California that safe and convenient pedestrian travel and access, whether by foot, wheelchair, walker, or stroller, be provided to the residents of the state.

(b) In accordance with the policy declared under subdivision (a), it is the intent of the Legislature that all levels of government in the state, particularly the Department of Transportation, work to provide convenient and safe passage for pedestrians on and across all streets and highways, increase levels of walking and pedestrian travel, and reduce pedestrian fatalities and injuries.



CALIFORNIA LAWS GOVERNING PEDESTRIAN CROSSINGS

Drivers must yield to pedestrians:

21950. (a) The driver of a vehicle shall yield the right-of-way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at an intersection, except as otherwise provided in this chapter.

But...

(b) This section does not relieve a pedestrian from the duty of using due care for his or her safety. No pedestrian may suddenly leave a curb or other place of safety and walk or run into the path of a vehicle that is so close as to constitute an immediate hazard.



CALIFORNIA LAWS GOVERNING PEDESTRIAN CROSSINGS

Pedestrians may cross midblock – must yield to traffic:

21954. (a) Every pedestrian upon a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to all vehicles upon the roadway so near as to constitute an immediate hazard.

But...

(b) The provisions of this section shall not relieve the driver of a vehicle from the duty to exercise due care for the safety of any pedestrian upon a roadway.

Pedestrians may not cross midblock :

21955. Between adjacent intersections controlled by traffic control signal devices or by police officers, pedestrians shall not cross the roadway at any place except in a crosswalk.

MARKED CROSSWALK PURPOSE

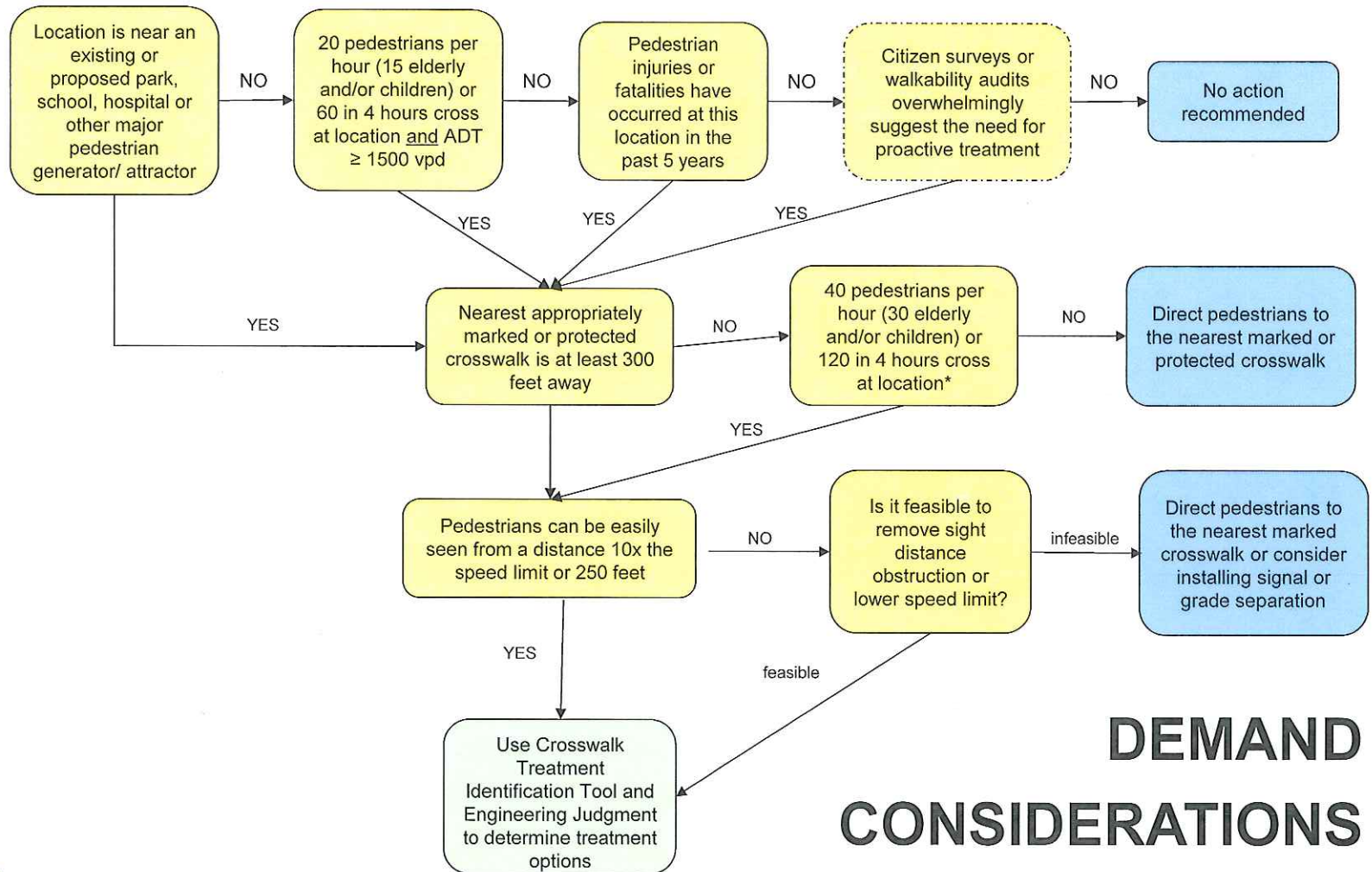
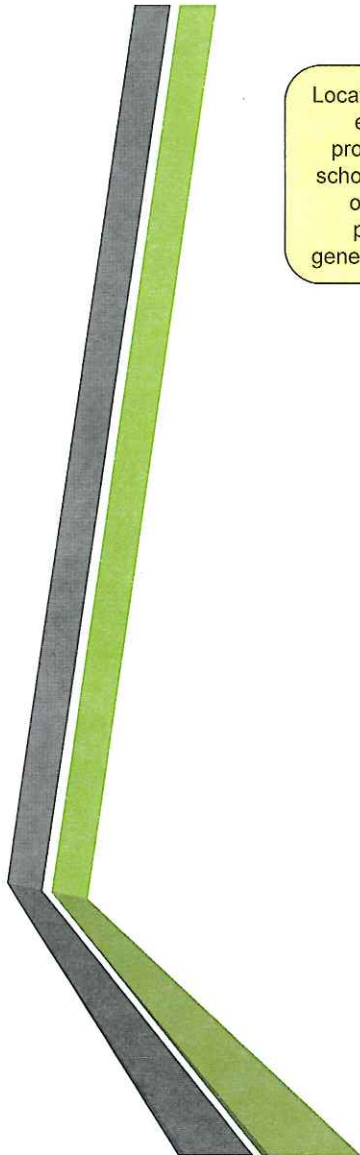
- Provide guidance for pedestrians
- Help alert drivers to pedestrian crossing
- Establish legal mid-block crossing



Decorative crosswalk



Hopscotch crosswalk in Baltimore



DEMAND CONSIDERATIONS

UNCONTROLLED CROSSINGS DECISION MAKING & DESIGN

To Mark or Not to Mark?



Hermes, Bruce. (1972) Pedestrian crosswalk study: accidents in painted and unpainted crosswalks. Transportation Research Record, 406.

- “The San Diego study”
- Marked crosswalks vs. unmarked crosswalks
- Increased incidence of pedestrian collisions in marked crosswalks
- Did not differentiate between:
 - Number of lanes
 - Traffic volume
 - Speed limit



UNCONTROLLED CROSSINGS DECISION MAKING & DESIGN

To Mark or Not to Mark?

Safety Effects of Marked versus
Unmarked Crosswalks at Uncontrolled
Locations (2002)

- “The Zegeer study”
- Marked vs. unmarked
- Two-lane roads - no difference in pedestrian crash rate
- Multilane roads - marked crosswalk, without other measures, associated with higher crash rate on roadways with higher ADT and speed





MULTIPLE THREAT CRASH

UNCONTROLLED CROSSINGS DECISION MAKING & DESIGN

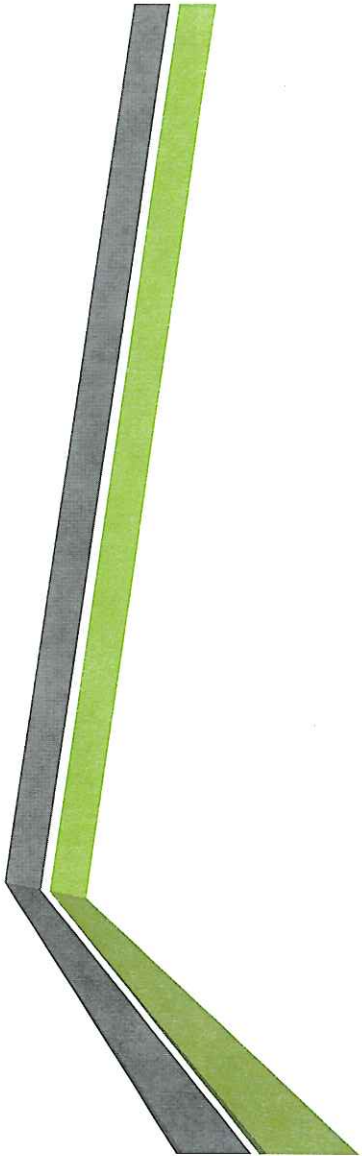
Zegeer Study Key Findings

Table 1. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

Key:

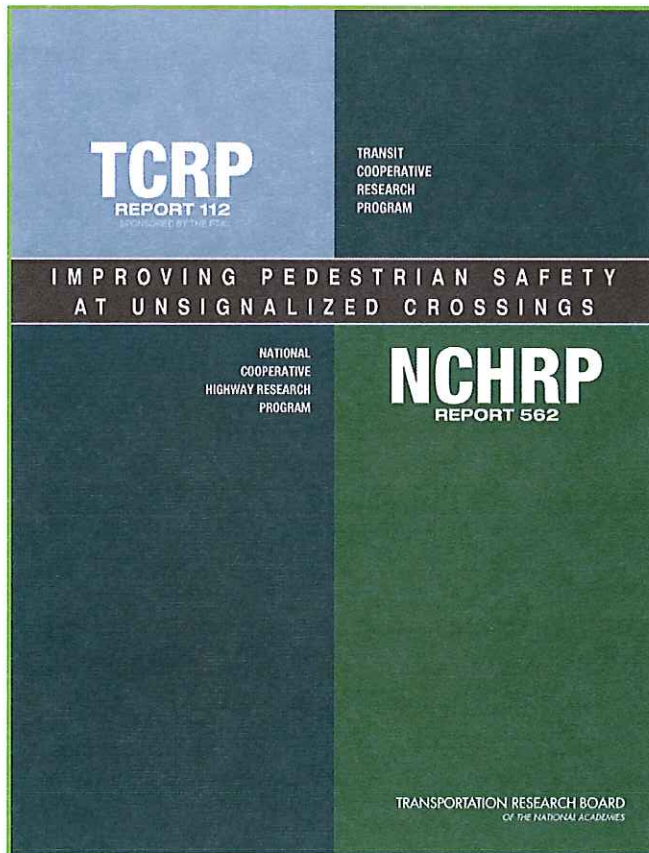
- C = Candidate sites for marked crosswalks;
- P = Possible increase in pedestrian crashes may occur if crosswalks are marked without other pedestrian enhancements;
- N = Marked crosswalks alone are insufficient.



“ Regardless of whether marked crosswalks are used, there remains the fundamental obligation to get pedestrians safely across the street. ”




FHWA Safety Effects of Marked v. Unmarked Crosswalks

CROSSWALK SAFETY BACKGROUND



TCRP/NCHRP: Improving Pedestrian Safety at Unsignalized Crossings

TABLE D-1. Summary of Treatments for Major Street Crossings at Uncontrolled Locations.

Treatment Type	Picture of Treatment
Roadway Signing Description – Special signs are placed in the roadway within or near the crosswalk. <ul style="list-style-type: none"> • Application – Crossing on higher volume multilane roads • Cost (Including Labor) in U.S. Dollars – \$200-\$300 per sign • Studies of Effectiveness – Field Evaluation Report (45), <i>Pedestrian Facilities Guidebook</i> (46) • Countries Where Treatment is Used – U.S.A., France, Sweden 	 <p>New York, U.S.A.</p>
High-Visibility Markings Description – This method uses ladder- or “zebra”-style crosswalk pavement markings. <ul style="list-style-type: none"> • Application – Crossings on higher-volume multilane roads • Cost (Including Labor) in U.S. Dollars – \$500-\$1,000 per crossing • Studies of Effectiveness – See section 6.2 of ITE Informational Report (44) • Countries Where Treatment is Used – U.S.A., Europe, Australia, New Zealand 	 <p>Puget Sound Area, Washington, U.S.A.</p>
Double-Posted Pedestrian Crossing Signs Description – Standard pedestrian crossing signs are installed on both sides of the approaching roadway at an uncontrolled crosswalk in addition to the near-side pedestrian warning signs posted at and in advance of the crosswalk. <ul style="list-style-type: none"> • Application – Uncontrolled marked crosswalk • Cost (Including Labor) in U.S. Dollars – \$200 per sign • Studies of Effectiveness – None found • Countries Where Treatment is Used – U.S.A., Canada 	 <p>Near Downtown Los Angeles, California, U.S.A.</p>

Milwaukee WI

Advance yield line (shark's teeth) & sign
Consider double white lines for no passing

2009 MUTCD Section 3B.16 and Figure 3B-17

CROSSWALK DESIGN

Rectangular Rapid Flashing Beacons (RRFBs)

- Solar or wired power
- Active detection (push button) - ADA Compliant (APS)
- Passive detection - Bollards, video, microwave
- Two RRFBs per approach
- RRFB in median if there is a median
- Allowable to mount overhead



Two RRFBs per approach



Passive detection bollards



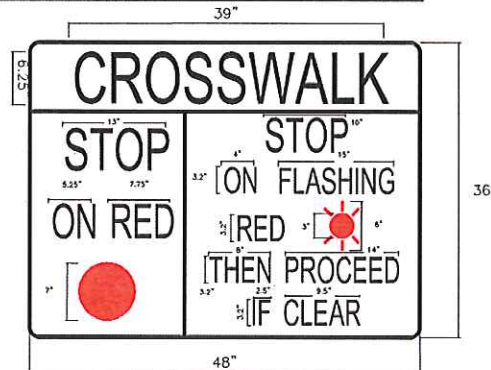
Pedestrian confirmation lights

CROSSWALK DESIGN

Pedestrian Hybrid Beacons (previously "HAWKs")



Standard R10-23 sign



Modified R10-23 sign

- Similar in design and cost to pedestrian signal
- Current MUTCD says PHB should not be installed within 100' of intersections
- Shall only be used to control one crossing at an intersection
- Shall have a minimum of two signal heads per approach
- Pedestrian head shall rest with upraised hand*

CROSSWALK DESIGN

Pedestrian Hybrid Beacons (previously "HAWKs")



1
Blank for
drivers



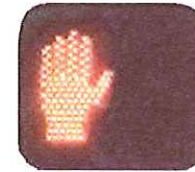
4
Steady red



2
Flashing
yellow



5
Wig-Wag



3
Steady
yellow



Return
to 1



UNCONTROLLED CROSSING DECISION MAKING & DESIGN

Device Selection Resources

XWalk+

Worksheet: Single 2 Lane

Date: 11-16-2015

Type: Uncontrolled Intersection

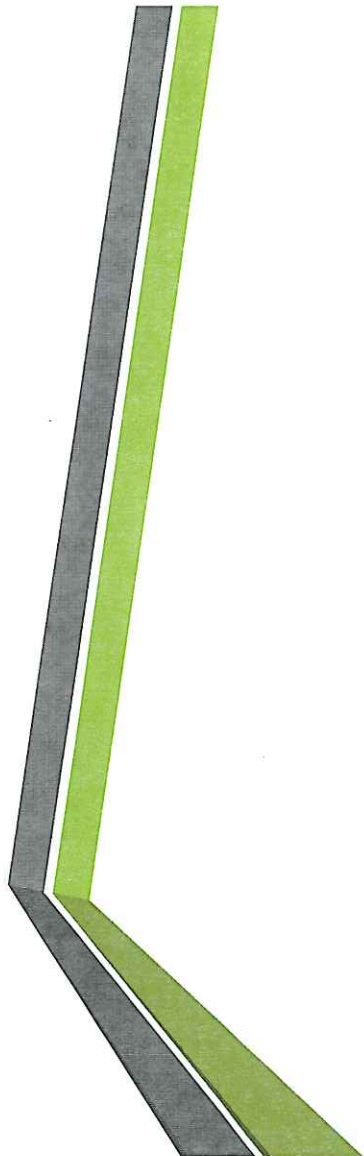
Input Parameters	Value	Intersection Characteristics	Yes	No
Speed Limit		Frequent at-grade crossings?	<input type="radio"/>	<input type="radio"/>
Peak Hour Pedestrian Vol		Bicycle lanes?	<input type="radio"/>	<input type="radio"/>
Major Road Peak Hour Volume Total		Heavy bicycle traffic?	<input type="radio"/>	<input type="radio"/>
Major Road Peak Hour Vol Dir 1		Major minor road intersection?	<input type="radio"/>	<input type="radio"/>
Major Road Peak Hour Vol Dir 2		Highly trafficked intersection?	<input type="radio"/>	<input type="radio"/>
Any Pedestrian Walking Speed		Heavy truck traffic?	<input type="radio"/>	<input type="radio"/>
15th Percentile Crossing Speed		Existing infrastructure limit violations?	<input type="radio"/>	<input type="radio"/>
Post stop/stop clearance time		On-street parking?	<input type="radio"/>	<input type="radio"/>
Pedestrian Crossing Distance		Residential area?	<input type="radio"/>	<input type="radio"/>
1st Half Crossing Distance		Building area of an isolated community?	<input type="radio"/>	<input type="radio"/>
2nd Half Crossing Distance		Median refuge island?	<input type="radio"/>	<input type="radio"/>
Number of Lanes		Sufficient width for a median?	<input type="radio"/>	<input type="radio"/>
Signal Total Pedestrian Delay				
Expected Mutual Compliance				

Device Recommendations

Consider installing LPI with No Right Turn on Red Sign.



Provides pedestrians with a walk indicator while all vehicle indicators display the red ball. This allows pedestrians to get a head start crossing the street before vehicles get the green indication. With the No Right on Red, vehicles do not conflict with the LPI phase.



COMMIT





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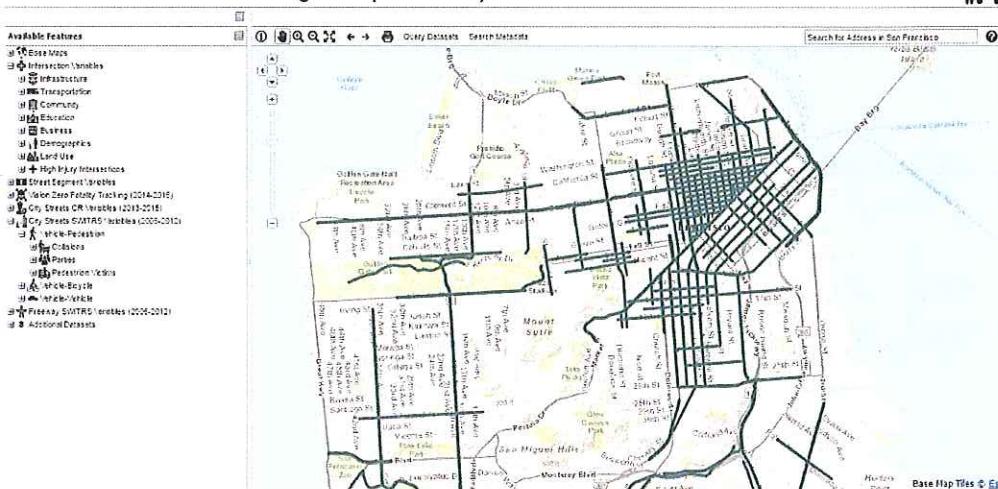
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BUILD

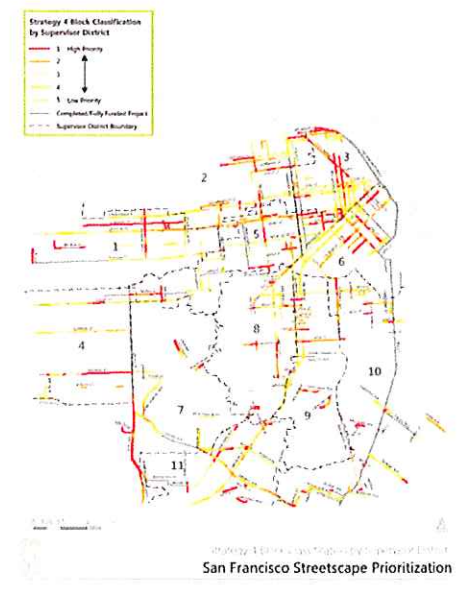
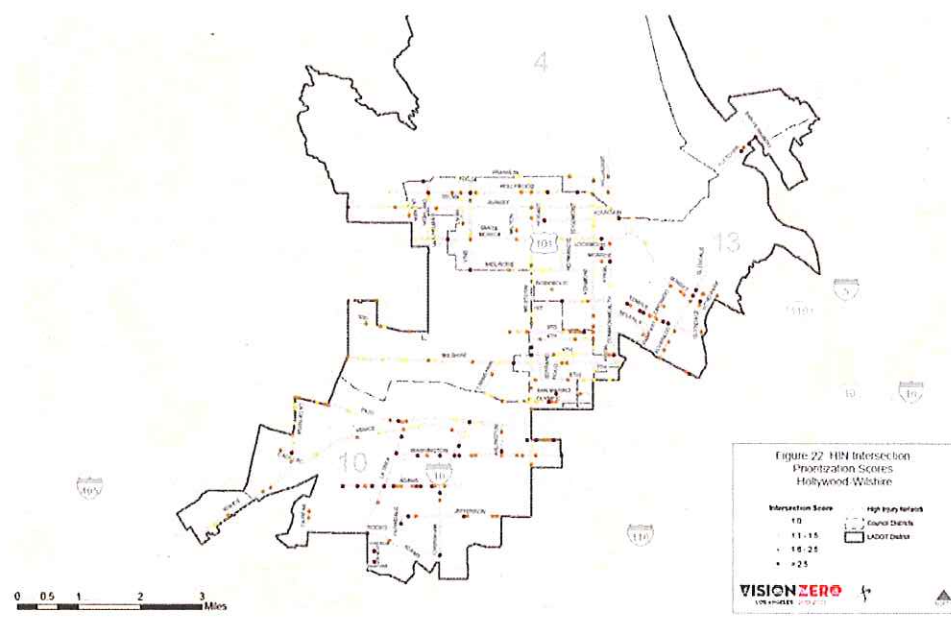


TransBASE: Linking Transportation Systems to Our Health



FEHR & PEERS

DEVELOP. ANALYZE. MATCH. PRIORITIZE.





A TECHNICAL GUIDE FOR CONDUCTING BICYCLE SAFETY ASSESSMENTS FOR CALIFORNIA COMMUNITIES

University of California, Berkeley
Institute of Transportation Studies
Technology Transfer Program



A TECHNICAL GUIDE FOR CONDUCTING PEDESTRIAN SAFETY ASSESSMENTS FOR CALIFORNIA COMMUNITIES

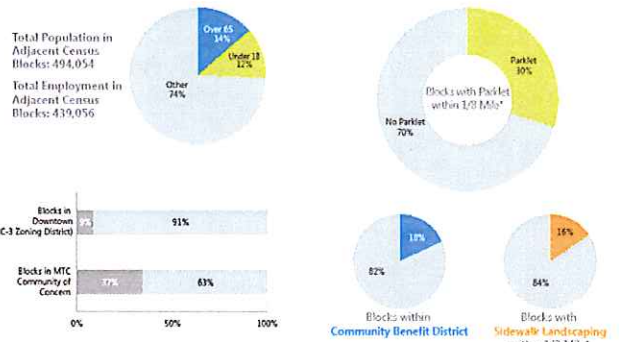
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IMPLEMENT

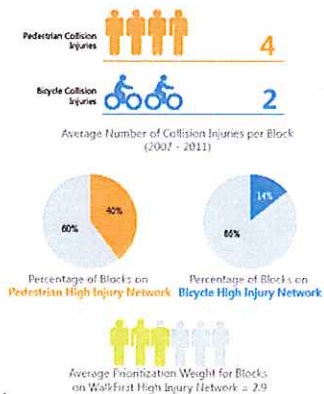
STRATEGY 4

PRIORITIZE BLOCKS WITH HIGH PEDESTRIAN ACTIVITY, POOR PEDESTRIAN ENVIRONMENT, AND NEIGHBORHOOD COMMERCIAL STREET TYPE

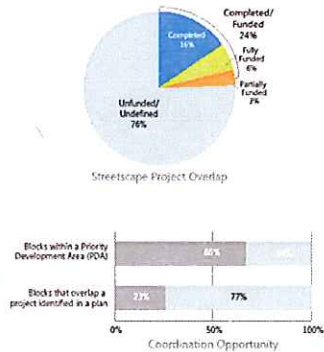


TARGETED POPULATION

STEWARDSHIP



SAFETY



EFFICIENCY

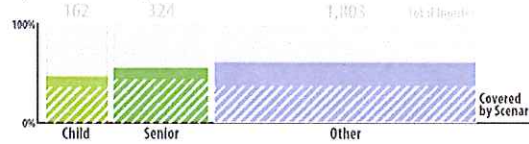
4 PRIORITY INJURY LOCATIONS

Phase I: cheap, effective Phase II: comprehensive

	Phase I	Phase II
Fatal/Severely Injured Covered	49%	71%
Total Cost of Countermeasures	\$8.5M	\$74.4M
Average Cost/Intersection	\$62K	\$381K
Average Cost/Injury	\$931K	\$883K

Total Cost for Scenario 4 - \$82.8M
 Total Cost Across High Injury Network - \$212M

Number of Citywide Injuries by Vulnerable Population



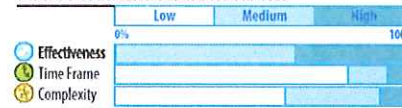
Selected Countermeasures

(Phase I, Phase II only)

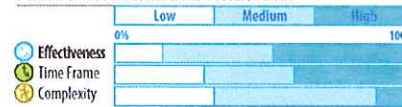
* Temporary in Phase I, permanent in Phase II

Advance stop or yield lines
 Automated speed enforcement
 Chokers
 Continental crosswalks
 Corner bulbs*
 Establish (mark) a new midblock crosswalk
 Flashing beacons
 Leading pedestrian intervals
 Mark an unmarked crosswalk
 Parking prohibitions (red visibility curbs)
 Pedestrian countdown signals
 Pedestrian detection to extend crossing time
 Pedestrian hybrid signal (HAWK)
 Pedestrian refuge islands*
 Pedestrian scrambles
 Pedestrian warning signage
 Protected left turns
 Radar speed display signs / Portable speed trailer
 Raised crosswalks
 Reduced lane widths
 Road diets
 Roadway safety lighting
 Signal timing changes
 Speed humps
 Speed tables
 Traffic circles, roundabouts
 Turn prohibitions

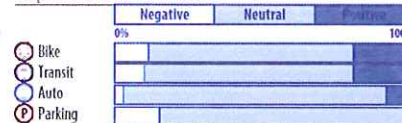
Phase I Countermeasure Attributes



Phase II Countermeasure Attributes



Impacts to Other Modes



EVALUATE



Figure 8
 Evaluation Metrics Infographic of Selected Strategy Prioritized Locations

FEHR PEERS



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Meghan Mitman AICP
Principal
Walnut Creek Office

925.930.7100
m.Mitman@fehrandpeers.com